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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/845,985	04/30/2001	Benjamin Chaloner-Gill	2950.20US01	2942

62274 7590 10/03/2007
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ART UNIT	PAPER NUMBER
1745	

MAIL DATE	DELIVERY MODE
10/03/2007	PAPER

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/845,985
Filing Date: April 30, 2001
Appellant(s): CHALONER-GILL ET AL.

Peter S. Dardi
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/16/2007 and corrected 6/26/2007 appealing from the Office action mailed 12/13/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The following are the related appeals, interferences, and judicial proceedings known to the examiner which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal: US Application 09/435,748 is a related appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(8) Evidence Relied Upon

US 5,538,814	KAMAUCHI et al.	7/23/1996
US 5,789,115	MANEV	8/4/1998
US 5,910,382	GOODENOUGH et al.	6/8/1999
US 5,849,827	BODIGER et al.	12/15/1998
US 5,952,125	BI et al.	9/14/1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112. Claims 1-3, 6-9, 12-21, 48-56 and 58-61 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which appellant regards as the invention.

In the claims, the phrase, "less than about" is indefinite as the limitation, "less than" describes a definite maximum value, while the word "about" contradicts that maximum end point value. Further, the phrase "greater than about" is indefinite as the limitation, "greater than", describes a definite minimum value while the word "about" contradicts that value. The same reasoning is applied to the phrase "at least about," for example in claim 53.

As shown in the MPEP, section 2173.05(b), the phrase "at least about" is held as indefinite where there is close prior art and nothing in the specification, prosecution history or prior art to provide an indication of what range of specific activity is covered by the term "about," with the MPEP citing Amgen Inc. vs. Chugi Pharmaceutical Co. Ltd. It is noted that prior art has been applied with respect to the claimed particle size. The same reasoning is applied to the phrases, "less than about" and "greater than about."

Claim Rejections - 35 USC § 103. Claims 1-3, 6-7, 12, 14-17, 19-21, 48-50, 52-53, 55-56 and 58-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamauchi et al. (US 5,538,814), in view of Manev (US 5,789,115.)

The instant claims are to a collection of particles comprising a crystalline composition with a phosphate anion and a lithium cation; the collection of particles has an average particles size of less than about 1000 nm and i) having essentially no particle with a diameter greater than about 5 times the average particle size (independent claims 1 and 21,) OR ii) having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter (independent claims 55 and 58.)

Kamauchi et al. (US 5,538,814) teaches a lithium secondary battery with a lithium cobalt phosphate active material with an average particle size of 10 nm to 20 μm (see claims 1-14, claim 3.) Examples 10 and 12 and Table 7 teach active material sizes on the order of 500 and 10 nm. The reference teaches ball-milling the materials to give small particles sizes. Other metals may be added to the lithium cobalt phosphate active material (col. 4, lines 10-65.) Lithium, cobalt and nickel are included in the active material of example 4. The material may be crystalline or amorphous (see col. 6, lines 1-20.) The material may be of the formula $LiCoPO_4$ with Fe substituted for the Co (see column 4, lines 15-55.) Various substituents may be substituted into the lithium transition metal oxide complex (col. 1, lines 55-67.) The lithium transition metal oxide active material is uniformly blended and formed into a positive electrode. The Kamauchi reference teaches a uniformly blended mixture where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode. With regard to the phrases "less than about," "greater than about," and "at least about" in the claims, the reference is considered to include points both within and "about" the end points of the range based on the teachings of 10 nm to 20 μm.

The reference does not teach that the collection of particles has essentially no particle with a diameter greater than about 3 times or 5 times the average particle size OR that at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

Manev (US 5,789,115) teaches cathode materials for a lithium battery. Manev teaches that the mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries. The properties are important because they directly influence the charge-discharge rate capacity, the safety cell performance and other features of the battery. A decrease in the mean particle size and the distribution typically results in an increase in the cycleability of these electrode active materials (col. 1, lines 34-50.) The lithium active material preferable have a narrow particle size distribution where the maximum particle diameter is less than about 10 times the mean particle diameter and/or at least about 90% of the particles are distributed in a range not wider than about 1 order of magnitude (col. 2, lines 30-55.) Smaller particles are relatively more flexible and cycling does not damage the material to the degree of larger particles. Based on the teachings of Kamauchi and Manev, it would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare an electrode comprising a collection of electrode material particles as taught in Kamauchi having a greater number of particles as close in size to the desired average diameter as possible, as a uniform, average diameter has been shown to be critical to the invention (see Kamauchi col. 5, lines 25-end; Manev col. 1, lines 34-50.) Similarly, it would be obvious to have an electrode with at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

The Kamauchi reference teaches a uniformly blended mixture where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode (col. 25, lines 25-end.) Having a broad range of active material particle sizes will cause a less uniform blended mixture giving large, irregular pores, which is taught to be undesirable by the reference. One of ordinary skill in the art, based on the teachings of Kamauchi and Manev, may select and prepare particles of preferred sizes by pulverizing or filtering the materials. The maximum particle size is about 1000 nm, or 1 micron and 5 times that is 5 microns. Particles of this size may be pulverized or filtered from the collection of particles (Kamauchi, col. 5, lines 30-36.) As Kamauchi teaches submicron lithium metal oxide and phosphates active materials uniformly blended such that no undesirably large, irregular pores are formed, which cause cracks and defects in an electrode and decrease the capacity of the electrode and Manev teaches that a decrease in the mean particle distribution typically results in an increase in the cycleability of a battery, the skilled artesian would conclude from the teachings of Kamauchi and Manev that a decrease in the mean particle distribution typically results in a uniform mixture that gives an increase in the cycleability of a battery during it's charge/discharge cycle.

Further, one of ordinary skill in the art would be motivated to choose specific particles for the electrode having a size about the average diameter, as particles of this diameter are taught to increase the capacity of the electrode (Kamauchi, col. 5, lines 40-45.) Pulverizing the particles will provide particles in the nanometer scale range (Kamauchi, col. 5, lines 30-36 teaches a low range of 10 nm.) It is noted that MPEP 2144.05(b) states that optimization of ranges within prior art conditions or through routing experimentation is not inventive. The

artesian would have found the claimed invention to be obvious in light of the teachings of the references.

Claims 8-9 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodenough et al. (US 5,910,382), in view of Kamauchi et al. (US 5,538,814) and Manev, as applied in the previous section.

Goodenough et al. (US 5,910,382) teaches cathode materials for a lithium secondary battery with lithium transition metal oxide complexes including $LiFePO_4$ and $LiFe_{1-x}Mn_xPO_4$, where x is between 0 and 1. The battery anode is lithium metal or a lithium intercalation material (see col. 1.) The reference is silent to the size of the active material particles. Thus, the reference does not teach that the collection of particles has essentially no particle with a diameter greater than about 3 times or 5 times the average particle size OR that at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

Kamauchi et al. (US 5,538,814) teaches a lithium secondary battery with lithium transition metal oxide complexes with an average particle size of 10 nm to 20 μm (see col. 5, line 25 to col. 6, line 20 and claims 1-14.) Other metals may be added to the active material including iron and manganese (col. 1, lines 55-end and col. 4, lines 10-65.) The electrode material is pulverized into particles having an average size of 10 nm to 20 μm.

Manev (US 5,789,115) teaches cathode materials for a lithium battery. Manev teaches that the mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries. The

properties are important because they directly influence the charge-discharge rate capacity, the safety cell performance and other features of the battery. A decrease in the mean particle size and the distribution typically results in an increase in the cycleability of these electrode active materials (col. 1, lines 34-50.) Smaller particles are relatively more flexible and cycling does not damage the material to the degree of larger particles. The figures show various particle distributions.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare the cathode materials of Goodenough et al. (US 5,910,382) with a size of less than 1000 nm, as small sizes provide an increased surface area and uniform dispersion through the electrode, which increases the capacity of the positive electrode as shown by Kamauchi et al. (US 5,538,814.) Based on the teachings of Kamauchi and Manev, it would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare an electrode from a collection of particles having a greater number of particles as close in size to the desired average diameter as possible, as the average diameter has been shown to be critical to the invention (see Kamauchi col. 5, lines 25-end; Manev col. 1, lines 34-50.) The Kamauchi reference teaches a uniformly blended mixture to prevent undesirably large, irregular pores from being formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode. The reference further teaches that increasing the time of ball milling reduces the size of the active material (examples 10-12.) Having a broad range of active material particle sizes will cause a less uniform blended mixture giving large, irregular pores, which is taught to be undesirable by the reference. One of ordinary skill in the art, based on the teachings of Kamauchi and Manev, may select and prepare particles of preferred sizes by pulverizing or

filtering the materials. The maximum particle size is about 1000 nm, or 1 micron and 5 times that is 5 microns. Particles of this size may be pulverized or filtered from the collection of particles (Kamauchi, col. 5, lines 30-36.)

Further, one of ordinary skill in the art would be motivated to choose specific particles for the electrode having a size about the average diameter, as particles of this diameter are taught to increase the capacity of the electrode (Kamauchi, col. 5, lines 40-45.) Pulverizing the particles will provide particles in the nanometer scale range (Kamauchi, col. 5, lines 30-36 teaches a low range of 10 nm.) It is noted that MPEP 2144.05(b) states that optimization of ranges within prior art conditions or through routing experimentation is not inventive. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

Claims 54, 58, 59 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bodiger et al. (US 5,849,827), in view of Bi et al. (US 5,952,125.)

Bodiger et al. (US 5,849,827) teaches a collection of particles of inorganic powders including aluminum phosphate. Aluminum phosphate is a well-known active material in lithium batteries. The particles have a mean particle diameter of 1-50 nm (see claims 1-9.) The particles are finely divided inorganic powders (claim 9.) The reference teaches a collection of aluminum phosphate particles with a particle size of 0.1-100 nm, preferably 1-50 nm, and in particular 1-30 nm that are extremely finely divided (col. 1, lines 40-50.) The reference is silent to the crystallinity of the material and does not suggest that the material is either crystalline or amorphous. It would have been obvious to one of ordinary skill in the art at the time the

invention was made to prepare the powder either as a crystalline material or as an amorphous material as the material will provide a significant reduction in burning times in a molding composition regardless of the state of crystallinity. One of ordinary skill in the art would recognize that the crystallinity of the material would not affect these properties of the composition.

The reference does not teach that the collection of particles that has at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter. Bi et al., however, teaches forming cathode active materials having a high degree of uniformity with a particle distribution where at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter (col. 8, lines 27-42.) The cathodes are used in lithium batteries with lithium anodes. It would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare an aluminum phosphate cathode mixture with at least 95 percent of the particles having a diameter greater than about 40 percent and less than about 160 percent of the average diameter, as taught in Bi to give improved characteristics such as energy density and capacity (see col. 2, lines 12-20.) Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have essentially no particle with a diameter greater than about 5 times the average particle size since uniformity of greater than about 40 percent and less than about 160 percent of the average diameter. One of ordinary skill in the art would recognize from the cited teachings that when a desired average diameter is disclosed in the prior art, choosing particles close to that diameter would be desirable for the function described in the reference. Thus, a collection of particles chosen to have a diameter of at least 95 percent of the particles

have a diameter greater than about 40 percent and less than about 160 percent of the average diameter would be desirable as the finely divided inorganic powder taught by Bodiger et al. These materials will function as the extremely finely divided material in the electrodes taught by Bodiger. MPEP 2144.05(b) notes that optimization of ranges within prior art conditions or through routing experimentation is not inventive. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

(10) Response to Argument

Claim Rejections under 35 USC § 112. Appellant argues that the phrases, "at least about", "less than about" and "greater than about" are not indefinite because one of ordinary skill in the art would understand what is claimed when read in light of the specification. Appellant further states that the examiner has not established a *prima facie* case of indefiniteness.

This argument is not persuasive, as it is not clear what particle sizes are encompassed by the claims. In the claims, the phrase, "less than about" is indefinite as the limitation, "less than" describes a definite maximum value, while the word "about" contradicts that maximum end point value. Further, the phrase "greater than about" is indefinite as the limitation, "greater than", describes a definite minimum value while the word "about" contradicts that value. The same reasoning is applied to the phrase "at least about." By using this language, it is not clear what defines the scope of the claim. To support this reasoning, section 2173.05(b) of the MPEP has been cited which states that the phrase "at least about" is held as indefinite where there is close prior art and nothing in the specification, prosecution history or prior art to provide an indication of what range of specific activity is covered by the term "about," with the MPEP citing Amgen Inc. vs. Chugi Pharmaceutical Co. Ltd. It is noted that close prior art has been applied with

respect to the claimed particle size. With respect to appellant's argument that the examiner relies on the Amgen case, this is not accurate. The examiner is relying on the guidance of the MPEP. It is the MPEP that cites Amgen. The examiner cannot simply ignore the guidance of the MPEP.

The rejection is not based on the use of the word "about" in the claims. The rejection is based on the use of an end point in the claim and then using the word "about" in conjunction with the end point, coupled with the guidance of the MPEP. By using this language in the claim, one cannot determine if points greater than the end point are within the scope of the claim and, if so, then to what degree. With respect to the cited section of the MPEP, there is close prior art and nothing in the specification, prosecution history or prior art to provide an indication of what range of specific activity is covered by the term "about" in the phrases, as claimed.

As an example of determining the scope of the claim, Appellant discusses the precision of measurements and states that the conclusion of one court is that a whole number used to approximate a continuous variable inherently has an approximate nature. Appellant apparently concludes that using the phrase "less than about" or "greater than about" is therefore not indefinite. This argument is not persuasive because if the whole number inherently has an approximate nature, then there is no reason to add the word "about" because it brings into doubt the scope of the claim.

In addition, the claims at hand are referring to *nanometer-sized* particles. If these particles are measured with such precision to determine a specific size, a nanometer as claimed, there is no need for the degree of error to more than a nanometer. The imprecision should be a small fraction of the size measured. The plus-minus error should not be more than a nanometer

and thus the end point of the range should suffice to cover any imprecision of the claimed invention.

The appellant further argues that many patents have issued using the phrases rejected as indefinite. It is well known that the claims are examined on a case-by-case basis and that all patent applications do not have the same fact pattern. As noted above, this application uses the phrases, "less than about" and "greater than about" when *close prior art* is applied. Perhaps in the cases noted by appellant, close prior art was not cited. Again, the examiner simply cannot ignore the section of the MPEP, which states that, in this situation, the claims are indefinite. Appellant argues that the particle sizes of the prior art are simply not close to the claimed particle sizes and that the rejection based on section 2173.05(b) of the MPEP is not proper. This position is clearly not accurate since the prior art teaches particles sizes that anticipate the claimed invention.

Claim Rejection under 35 USC § 103 over Kamauchi et al. (US 5,538,814), in view of Manev (US 5,789,115.) The instant claims are to a to a collection of particles comprising a crystalline composition with a phosphate anion and a lithium cation; the collection of particles has an average particles size of less than about 1000 nm. The collection of particles also has one of the following two limitations: i) particles having essentially no particle with a diameter greater than about 5 times the average particle size OR ii) particles having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter. The collection of particles is used as an electrode material for a battery. The claims are rejected over Kamauchi et al. (US 5,538,814), in view of Manev (US 5,789,115.) Kamauchi et al. (US 5,538,814)

teaches a lithium secondary battery having a lithium cobalt phosphate active material with an average particle size of 10 nm to 20 μm (see claims 1-14, claim 3.) The reference further teaches lithium metal oxide active materials where various metals may be substituted into the lithium transition metal oxide complex (col. 1, lines 55-67.) The active material is a uniformly blended mixture where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode (see col. 5.)

The secondary reference, Manev (US 5,789,115), teaches lithium metal oxide cathode materials for lithium batteries. Manev teaches that the mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries. A decrease in the mean particle size and the distribution results in an increase in the cycleability of these electrode active materials (col. 1, lines 34-50.) The active material preferably have a narrow particle size distribution where the maximum particle diameter is less than about 10 times the mean particle diameter and/or at least about 90% of the particles are distributed in a range not wider than about 1 order of magnitude (col. 2, lines 30-55.) The properties are important because they directly influence the charge-discharge rate capacity, the safety cell performance and other features of the battery. A decrease in the mean particle size and the distribution typically results in an increase in the cycleability of these electrode active materials (col. 1, lines 34-50.) Smaller particles are relatively more flexible and cycling does not damage the material to the degree of larger particles.

Appellant argues that the claims are not obvious over the prior art because the primary reference, Kamauchi, does not teach the claimed particle size uniformity and that the secondary reference to Manev also does not teach the claimed uniformity. This has been addressed in the

rejection. In response to appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The following sections are directed to the combination of references.

In addition, appellant argues that the Manev patent teaches lithium metal oxides and not lithium metal phosphates. While this is true, the Kamauchi reference teaches both lithium phosphates and oxides as electrode active materials and one of ordinary skill in the art, argued to be a Ph.D. in the art by appellant, would recognize from the teachings of Manev that a decrease in the mean particle size and distribution typically results in an increase in the cycleability of lithium transition metal active materials such as lithium metal phosphates and oxides. As Kamauchi teaches submicron lithium metal oxide and phosphates active materials uniformly blended such that no undesirably large, irregular pores are formed and cause cracks and defects in an electrode that decrease the capacity of the electrode and Manev teaches that a decrease in the mean particle distribution typically results in an increase in the cycleability of a battery, the skilled artesian would conclude from these teachings that a decrease in the mean particle distribution typically results in a uniform mixture that gives an increase in the cycleability of a battery during it's charge/discharge cycle.

The combined disclosures of the references teach the skilled artesian that a submicron lithium transition metal phosphate active material having a decreased mean particle size distribution typically results in a uniform mixture which gives an increased cycleability of a battery using the active materials. Appellant further argues that Manev teaches away from the

claimed invention because it teaches particles on the micron scale. It is noted that the particles of Manev include mean particle sizes of 1 μm, which is 1000 nm (*about* 1000 nm is found in claim 1). Five times this amount is 5000 nm or 5 μm. Thus, the particles of Manev are on the order of the compounds found in the instant invention. However, the teachings of Manev are not relied upon to teach submicron size particles. Submicron size particles are disclosed in the primary reference, Makauchi. Manev is used to support the disclosure of Kamauchi, which teaches submicron lithium metal oxide and phosphate active materials uniformly blended such that no undesirably large, irregular pores are formed. These irregularities cause cracks and defects in an electrode and decrease the capacity of the electrode. Manev teaches that a decrease in the mean particle distribution typically results in an increase in the cycleability of a battery. From this, one of ordinary skill in the art is motivated to employ a submicron lithium transition metal phosphate active material having a decreased mean particle size distribution in a battery to give a uniform electrode mixture to increase the cycleability of a rechargeable battery. While smaller particles may increase the resistivity, smaller particles also provide increased cycleability, so one skilled in the art clearly has the knowledge to choose particle sizes that have the properties desired by the artesian. From this, it is clear that the prior art has developed an understanding of particle size distribution and how the sizes affect the battery.

Appellant further argues that milling or grinding the active material is not a desirable method of reducing the mean particle size and particle size distribution of the materials because it affects the function of the material in a battery. It is noted that the claims are simply to a collection of particles, not to an electrode or to a battery and therefore the performance of the particles in a battery is not commensurate in scope with the claimed invention. This argument

states that it is not desirable, however, the fact that the Appellant admits that the particles are this size does support the Kamauchi reference by teaching that it is possible to grind the material to the desired sizes. The process simply making small particles by grinding is taught to be successful. Kamauchi clearly teaches ball milling as a means of reducing the mean particle size in examples 10-12. The reference gives two specific examples that are less then 1000 nm. Example 12 teaches a size of 10 nm. Example 10 teaches an average particle size of 500 nm (Table 7.) Five times this amount is 2500 nm, or 2.5 micron. It would be obvious to one of ordinary skill in the art to remove particles of a large size by grinding or filtering as large particles give negative effects to a battery as taught in both Kamauchi and Manev. The Kamauchi reference teaches a uniformly blended mixture such that undesirably large, irregular pores are not formed in the electrode (see col. 5, lines 1-35.) These irregular pores cause cracks and defects that decrease the capacity of the electrode.

With regard to the arguments based on the 132 declaration, the declaration merely points out that the process of Kamauchi does not produce a collection of particles with the claimed particle distribution. This was acknowledged in the rejection. Kamauchi does teach the lithium transition metal active material is uniformly blended and formed into a positive electrode where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode. Further, the declaration supports the formation of the claimed material as submicron particles. The Manev reference was cited, along with Kamauchi, to show that one of ordinary skill in the art would be motivated to use uniform particles in an electrode. One of ordinary skill in the art would recognize that grinding particles under different conditions, such as for a longer time or with more pressure would

produce smaller particles. Further, it was noted in the rejection that one of ordinary skill in the art would be motivated to filter the particles to produce a uniform size. US patents 6,432,192 to Cook, 4,915,837 to Verity, and 4, 747,959 to Ho are examples that address filtering particles on a nanometer scale. Cook teaches a filter that preserves a narrow particle size distribution in the range of 3-3000 nm. Verity teaches filtering small particles in a range of 5-500 nm. Ho teaches filtering particles having a size distribution of less than 250 nm. The comparison of the instant claims are less than about 1000 nm and up for five times that size or 5,000 nm (which is 5 microns.) These filters are well known in the art for giving a collection of particles having a desired size distribution. Thus, the combination of reference renders the claimed invention obvious.

With regard to appellant's arguments in Groups 1-6, the combination of Kamauchi and Manev has been addressed in the previous section. Appellant again argues that Manev teaches away from the claimed invention because it teaches particles on the micron scale. It is noted that the particles of Manev include mean particle sizes of 1 μm, which is 1000 nm (*about* 1000 nm is found in claim 1). Eleven hundred nanometers may be considered "about" 1000 nm. Five times this amount is about 5000 nm or 5 μm. Thus, the particles of Manev are on the order of the compounds found in the instant invention. However, the teachings of Manev are not relied upon to teach submicron size particles. Submicron size particles are disclosed in the primary reference, Makauchi. Manev is used to support the disclosure of Kamauchi, which teaches submicron lithium metal oxide and phosphate active materials uniformly blended such that no undesirably large, irregular pores are formed. These irregularities cause cracks and defects in an electrode and decrease the capacity of the electrode. Manev further supports a uniform mixture,

as it teaches that a decrease in the mean particle distribution typically results in an increase in the cycleability of a battery.

With respect to these size distributions, it is noted that the appellant has argued that the office has not established a prima facie case of obviousness. From the teachings of the art and the response to appellant's arguments, it is believed that a strong rejection of obviousness has been established. To overcome this rejection, the burden is on the appellant to establish unexpected results for their invention. Appellant has not submitted *any evidence* in this regard. The claims are to a collection of particles, not to an electrode or a battery, but even in the event the claims were to such an electrode, no evidence has been presented. Appellant has merely argued that the particle size distribution is preferred for the same reasons taught in the prior art improved cycleability of a battery. Batteries using the claimed materials are well taught in the prior art and the motivation to use a uniform size distribution and mixture of particles is found in the art. There is nothing unexpected about using uniform particles to prepare an electrode for a lithium battery.

Claim rejection under 35 U.S.C. 103(a) over Goodenough et al. (US 5,910,382), in view of Kamauchi et al. (US 5,538,814) and Manev. Appellant argues that the "Goodenough patent does not make up for the deficiencies of the Kamauchi patent and the Manev patent described in detail above." The arguments with regard to rejections based on the Kamauchi patent and the Manev patent have been addressed in the previous section.

Claim rejection under 35 U.S.C. 103(a) over Bodiger et al. (US 5,849,827), in view of Bi et al. (US 5,952,125.) Appellant argues that this rejection generally has many levels of deficiencies. Appellant argues that neither reference teaches how to make nanoscale phosphates.

Appellant admits that the Bodiger does refer to aluminum phosphates at column 7, line 33, but Bodiger does not exemplify nano-scale phosphates or provide a reference to a source of these materials.

As the claims are not to a method, such a requirement is not commensurate in scope with the instant claims. Further, the claims are not to an electrode, but to a collection of particles. Bodiger clearly teaches nanoscale aluminum phosphate particles, as noted. Appellant further argues that the Bodiger reference only teaches particles sizes and not uniformity of these particles. In response to appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The Bodiger et al. (US 5,849,827) reference clearly teaches a collection of aluminum phosphate particles with a particle size of 0.1-100 nm, preferably 1-50 nm, and in particular 1-30 nm (claims 1, 6 and 9; col. 7, lines 20-end.) The materials are extremely finely divided. The particles have a mean particle diameter of 1-50 nm and are finely divided inorganic powders. Aluminum phosphate is a well-known active material in lithium batteries. As noted in the rejection, the Bodiger reference does not teach that the collection of particles that has at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

The Bi et al. reference is used to show a teaching that one of ordinary skill in the art is motivated to use uniform particles in a mixture that describes an average diameter. This reference is pertinent to the instant application as both use the particles in battery electrodes. Bi

teaches using cathode active materials having a high degree of uniformity with a particle distribution where at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter (col. 8, lines 27-42.) It would have been obvious to one of ordinary skill in the art to prepare a cathode of the aluminum phosphate materials taught in Bodiger with at least 95 percent of the particles having a diameter greater than about 40 percent and less than about 160 percent of the average diameter, as taught in Bi to give improved characteristics such as energy density and capacity (col. 2, lines 12-20.) Aluminum phosphate is a well-known active material in a battery.

Further, one of ordinary skill in the art would recognize that when a desired average diameter is disclosed in the prior art, choosing particles close to that diameter would be desirable for the function described in the reference. Thus, a collection of aluminum phosphate particles chosen to have a nanoscale diameter with at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter would be desirable as the finely divided inorganic powder in the thermoplastic molding taught by Bodiger et al. Using uniform materials will give a uniform mixture having uniform flame retardation properties.

Again, when describing the claimed collection of particles, the difference between the prior art and the claims is not the material or the particle sizes, but the distribution of particle sizes. Aluminum phosphate particles with a particle size of 0.1-100 nm, preferably 1-50 nm, and in particular 1-30 nm are taught in the reference. Appellant relies on the size distribution of particles in a collection of particles for novelty. Although the claims are not to an electrode or a battery, but to a collection of particles, appellant has not provided any *evidence* of unexpected

results for the material having the claimed broad distribution of particles. Absent and criticality or unexpected results, a uniform collection of known particles would be obvious to the skilled artesian.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

9/28/2007

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